

AN ECOLOGICAL STUDY OF THE DUNE FOREST AT MAPELANA, CAPE ST LUCIA, ZULULAND*

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ABSTRACT

A quantitative account of the composition of the Dune Forest at Mapelana is given. The prevailing environmental conditions and their influence on the vegetation are also briefly discussed.

UITTREKSEL

'N EKOLOGIESE STUDIE VAN DIE DUINWOUD VAN MAPELANA, KAAP ST LUCIA, ZULULAND*

'n Kwantitatiewe verslag van die samestelling van die duinwoud van Mapelana word aangebied. Die heersende omgewingsfaktore en die invloed daarvan op die plantegroei word ook kortliks bespreek.

INTRODUCTION

The Mapelana Forest, of which a small portion is to be seen in Fig. 1, is situated just north of Cape St Lucia (Fig. 2). The dunes on which the Forest grows, are approximately 2 km wide and up to 188 m high (Hobday, 1955). The dunes are adjacent to the coast and run parallel to it in a north-east/south-west direction.

The Department of Forestry has jurisdiction over most of the area, while the Natal Parks Board has an anglers' reserve at the northern boundary of the forest. Between these two bodies the forest is protected so effectively that very little disturbance was noticeable at the time of the investigation.

PHYSIOGRAPHY AND CLIMATIC FACTORS

The forest soil consists of unconsolidated brown sand. The mean moisture content of the top soil at field capacity is 12,7 per cent of the dry mass. The permanent wilting point is only a little lower, viz. 10,8 per cent of the dry mass. The moisture available to plant growth is thus very low, and wilting of the forest floor plants in particular is quickly detectable during a slightly prolonged dry spell. The pH of the forest top soil lies between 6,7 and 7,4 and the organic matter content varies from 4,6 to 6,2 per cent of the dry mass of the soil.

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The temperatures of the area are high in summer with a mean of 26,1 days per annum above 30°C; the extreme maximum recorded is 38,9°C. The winters are moderate, the lowest monthly mean being 13,4°C; the extreme minimum recorded is 5,7°C. The relative humidity is high with a monthly mean at 08h00 of between 79 and 88 per cent and at 14h00 between 61 and 74 per cent. From May to August



FIG. 1.

Part of the hinddune forest viewed from the west. In the foreground *Barringtonia racemosa* and *Ficus sycomorus* can be distinguished.

the relative humidity may drop below 70 per cent. The mean annual rainfall for this area is 1 287,9 mm. Sixty per cent of the total falls between October and March, with the peak in March when a mean of 204,2 mm is measured. From these data it may be deduced that a humid-subtropic climate favourable for plant growth prevails (Weather Bureau, 1954 & 1955).

METHODS OF SURVEY

In order to obtain an indication of the limits of the different forest zones and of the canopy trees characterizing them, transects traversing the dunes were laid out.

Due to the extreme density of the forest line transects with survey points at intervals of 10 paces were used. The area around every survey point was divided into quadrants. In each quadrant the tree species nearest to the survey point and of which the trunk diameter at breast height measured at least 10 cm, was listed. This minimum diameter ensured that mainly canopy-tree species which characterize the different forest zones were included. From the data obtained, histograms were

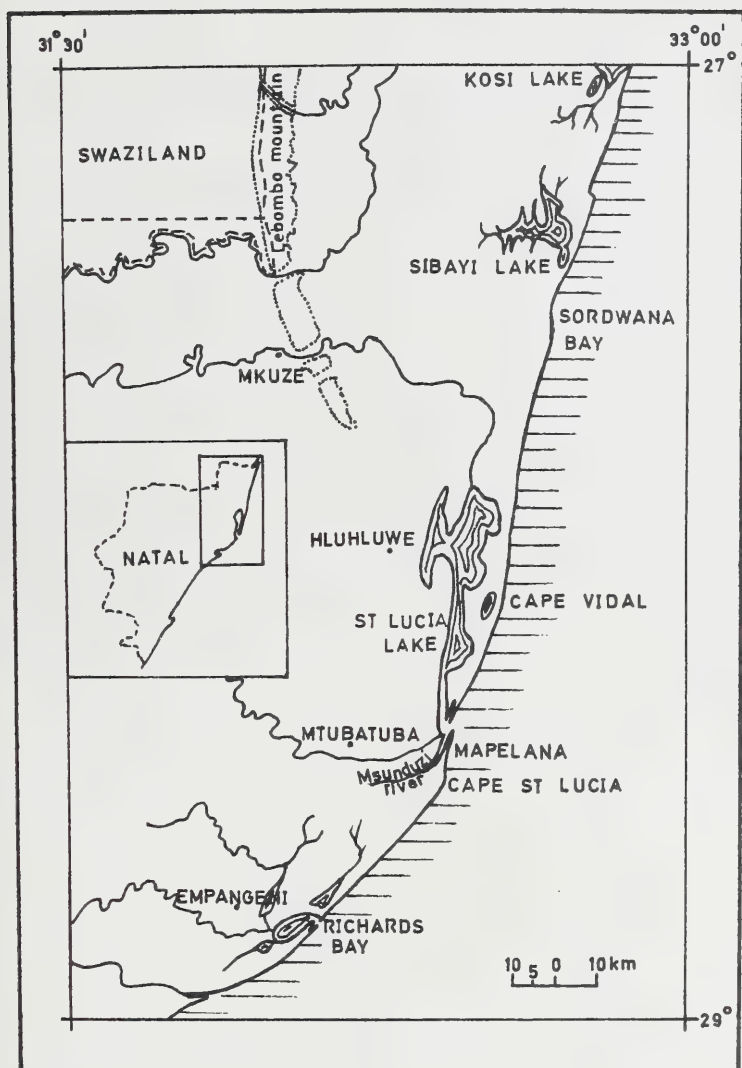


FIG. 2.
Locality map of the coast belt of Zululand.

compiled and from these figures the various zones or stands of the forest were delimited on the foredunes and the hinddunes.

Apart from the transect studies, a quantitative investigation was made of the hinddune forest to determine its composition. The survey was carried out according to the method of Cottam & Curtis (1959) and Curtis & Cottam (1964) whereby the canopy, subcanopy and lianas were studied with the quarter technique, and the herb stratum by quadrats. This plotless quarter method was adopted because of the extremely dense growth of the Mapelana Forest.

The criteria used in the present study to distinguish between the different strata are as follows:

Canopy stratum – Tree species of the forest canopy of which the trunk diameter at breast height (1.5 m above ground-level) measures at least 10 cm.

Subcanopy stratum – Tree and shrub species which never form part of the canopy stratum and of which the trunk diameter at breast height measures at least 2.5 cm. Saplings of the canopy species with trunk diameters of 2.5 to 10 cm at breast height are included in the subcanopy.

Herb stratum – Herbs, woody herbs, herbaceous climbers and seedlings of the canopy, subcanopy and lianas.

Lianas – Those woody climbers which reach at least the canopies of the trees of the subcanopy stratum.

Three surveys were made along the foot, slope and crest of the hinddune respectively. Each survey comprised 40 stratified points which were 10 paces apart on a single line of 400 paces long, placed roughly on a specific contour line of the dune. At each point the ground area was divided into quadrants and a quadrant of 1 m² was consistently located in the same position in relation to the point.

In each quadrant the tree species which grew nearest to the point, and which complied with the stipulated criteria for the canopy stratum, was listed. The basal area of the tree was measured at breast height with a basal area tape, and the height was measured with a range finder. A survey of 40 points thus provided data on 160 trees. A distance of 10 paces between consecutive points normally ensured that the same individual tree was not sampled more than once. If this, however, happened then the tree second nearest to the point was chosen.

The same procedure was followed for the lianas and the subcanopy, except that the height of the lianas was not measured and no basal area or height was measured in the case of the subcanopy species.

For the herb stratum the species present in the 1 m² quadrats, were listed.

The data of the three separate surveys were finally combined into one comprehensive set of data. From these data importance values (IV) were determined as follows:

Canopy species: $IV = (RF + RD + RDo)/3$ per cent

Liana species: $IV = (RF + RD + RDo)/3$ per cent

Subcanopy species: $IV = (RF + RD)/2$ per cent

Herb stratum species: $IV = RF$ per cent.

RF = *Relative frequency*, e.g. the number of occurrences of one species as a percentage of the total number of occurrences of all species.

RD = *Relative density*, e.g. the number of individuals of one species as a percentage of the total number of individuals of all species.

RDo = *Relative dominance*, e.g. the total basal cover of one species as a percentage of the total cover of all species.

In addition to the above values, the density per hectare (D/ha) was determined for the canopy, subcanopy and lianas. Basal cover per hectare (BC/ha) was determined for the canopy stratum only.

RESULTS AND DISCUSSION

The investigation revealed clearly that the Mapelana Forest comprises two distinct communities, viz. a sea-facing foredune community that is conspicuously affected by salt-spray from the sea and an inland-facing hinddune community where the influence of salt-spray is not obvious. Bayer and Tinley (1965) drew a similar distinction.

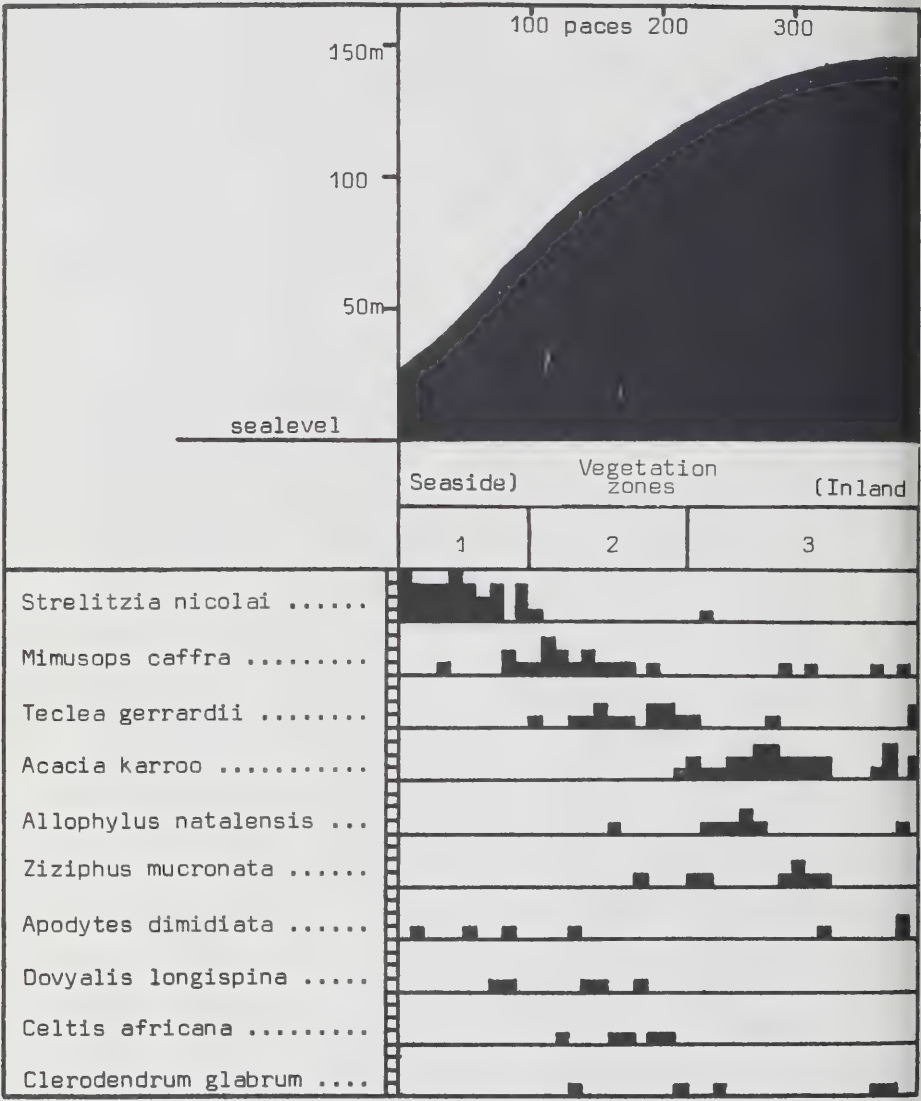
The condition is not restricted to the Mapelana Forest, but is present all along the coast of Natal wherever high sand-dunes occur, for example at Richards Bay and Sibayi Lake (Venter, 1973), Cape Vidal (personal observation, 1972) and Hawaan Forest (Moll, 1968).

The foredune community

The foredune community at Mapelana is not uniform in composition. Two main types of salt-spray forest are present. The most extensive of the two is characterized by the dominance of *Strelitzia nicolai*, *Mimusops caffra* and *Acacia karroo* (Fig. 3). *Strelitzia nicolai* is totally dominant just above the beach of wind-swept sand. It forms such an impenetrable growth that few other species apart from *Mimusops caffra* are observable. Above the zone of *Strelitzia nicolai* the forest becomes more mixed in composition with *Mimusops caffra* the dominant and *Teclea gerrardii* the subdominant. *Allophylus natalensis*, *Ziziphus mucronata*, *Dovyalis longispina* and *Apodytes dimidiata* are regularly encountered.

Although *Acacia karroo* represents the third zone in Fig. 3, this species is not present as a continuous belt along the foredune, but is more or less restricted to the borders of smaller patches or larger areas of grassland or blow-sand near or at the top of the dune. In places where the *Acacia karroo* zone is absent, the *Mimusops caffra* vegetation continues over the crest of the foredune to link up with the forest of the hinddune.

The second type of salt-spray forest at Mapelana is very dense, low-growing brushwood of *Diospyros rotundifolia*, *Mimusops caffra*, *Brachylaena discolor*, *Eugenia gueinzii*, *Ficus burtt-davyi* and *Euclea schimperii*.



The influence of the wind-blown salt-spray from the sea is distinctly demonstrated in this brushwood forest. Succulence of the foliage is very common. According to Boyce (1954) this condition is induced by a gradual accumulation of chloride ions in the leaves which eventually results in hypertrophic growth of the parenchyma cells. Most conspicuous, however, is the tangled growth form and evenly pruned canopies of the trees and shrubs. These conditions are direct results of salt-spray poisoning which kills off the terminal and other buds of stems exposed to salt-spray.

The hinddune community

This community does not reveal any observable symptoms of salt-spray poisoning. The steep and high foredune obviously protects the hinddune from salt-spray contamination. Venter (1973) found at Richards Bay that there is a marked drop in salt-spray intensity from the foredune to the hinddune area and that only a very low quantity is detectable at 1 000 m from the beach with no visible poisoning in the vegetation at this distance.

The zonation of the hinddune forest is indicated in Fig. 4. On the landward side a clearly demarcated belt of swampy, clayey alluvium is located between the foot of the dune and the Msunduzi River (zone 1 in Fig. 4). *Ficus sycomorus* and *Barringtonia racemosa* are more or less exclusive but individuals of *Hibiscus tiliaceus*, *Rauvolfia caffra*, *Voacanga thouarsii* and *Ficus hippopotami* are also present. (The last mentioned species is the dominant tree in the vast swamp of *Cyperus papyrus* on the inland side of the Msunduzi River.) The *Ficus sycomorus* trees are huge emergents up to 19 m tall (Fig. 1) and have typical buttressed trunks. *Barringtonia racemosa* in contrast, never acquires such dimensions, but is present in such large numbers that it forms one continuous, dense subcanopy below *Ficus sycomorus*. Many seedlings and saplings of *Barringtonia racemosa* are present in the understorey which indicates that this species reproduces itself actively under the prevailing conditions.

On the seaward edge of the hinddune forest *Mimusops caffra* and *Acacia karroo* are the most important species (Fig. 4, zone 3). This zone borders on the already mentioned extensive area of grassland and blow-sand that separates the forest of the foredune from that of the hinddune. In places, however, the foredune and hinddune communities have converged into one continuous belt of forest across the dunes.

Acacia karroo is apparently invading the grassland and blow-sand, but once it has formed dense stands, none of its seedlings are to be observed, probably

FIG. 3.

Histogram of the foredune forest at Mapelana representing the distribution of the main tree species from the beach to the grassland on top of the dunes. (The histogram is compiled from a line transect of 40 points, every two points 10 paces apart. One division of the vertical scale represents 25 per cent frequency at a survey point.)

because this species is a heliophyte. The result of its absence in the lower strata is that *Mimusops caffra* and *Celtis africana* invade the stands of *Acacia karroo* and eventually replace it. Breen (1971) similarly found little evidence of regeneration of *Acacia karroo* in its stands in the dune forest at Lake Sibayi. Surprisingly he also found no saplings or seedlings of other forest species present in these stands. A possible explanation for this may be that the stands of *Acacia karroo* at Lake Sibayi were still so young that conditions were not yet favourable for the appearance of other species. Venter (1973) studied stands of various ages at Richards Bay and found other tree species to appear in older stands of *Acacia karroo*.

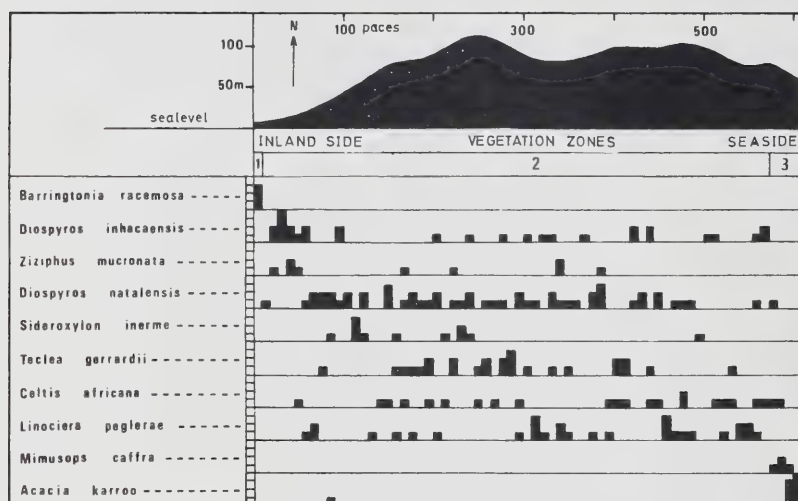


FIG. 4.

Histogram of the hinddune forest at Mapelana representing the distribution of the main tree species from the Msunduzi River across the dunes to the grassland on the seaward side of the forest. (The histogram is compiled from a line transect of 62 points, every two points 10 paces apart. One division of the vertical scale represents 25 per cent frequency at a survey point.)

Observations of this border zone furthermore suggest that also *Mimusops caffra* eventually disappears from the forest and that it acquires a more mixed composition of *Diospyros natalensis*, *Celtis africana*, *Strychnos madagascariensis*, *Teclea gerrardii* and *Linociera peglerae* as illustrated in Fig. 4, zone 2. Thus there apparently exists a sequence of successional stages as forest vegetation invades grassland and blow-sand on the dunes. Similar trends are to be observed elsewhere along the coast of Zululand (Venter, 1973).

Diospyros natalensis is the most conspicuous species and has an importance

Relative frequency, density and dominance, importance values, basal cover and density per hectare of the canopy species of the *Diospyros natalensis* community.
(Summary of the data of a survey of 160 points)

	RF	RD	RDo	IV	BC/ha (m ²)	D/ha
<i>Diospyros natalensis</i>	19,7	26,2	15,1	20,3	5,96	182
<i>Celtis africana</i>	8,9	8,9	13,0	10,3	5,13	62
<i>Strychnos madagascariensis</i>	7,3	7,7	11,5	8,8	4,54	54
<i>Linociera pegerlae</i>	8,5	7,7	5,0	7,1	1,97	54
<i>Ziziphus mucronata</i>	4,8	4,2	12,2	7,1	4,81	29
<i>Teclea gerrardii</i>	7,8	7,3	3,7	6,3	1,46	51
<i>Sideroxylon inerme</i>	5,8	5,4	6,7	6,0	2,64	39
<i>Diospyros inhaecaensis</i>	6,3	5,8	4,7	5,6	1,85	41
<i>Chaetacme aristata</i>	2,9	2,5	4,3	3,2	1,70	17
<i>Cassine papillosa</i>	3,3	3,1	3,3	3,2	1,30	22
<i>Dovyalis longispina</i>	4,1	3,4	1,8	3,1	0,71	24
<i>Apodytes dimidiata</i>	1,8	1,7	3,4	2,3	1,34	12
<i>Eugenia natalitia</i>	2,9	2,5	1,1	2,2	0,42	17
<i>Drypetes natalensis</i>	2,2	1,9	0,7	1,6	0,28	13
<i>Cassine aethiopica</i>	1,8	1,5	1,3	1,5	0,51	10
<i>Euclea schimperi</i>	1,8	1,7	1,0	1,5	0,39	12
<i>Olea capensis</i> subsp. <i>macrocarpa</i>	1,0	1,0	2,0	1,3	0,79	7
<i>Ficus polita</i>	0,5	0,4	2,6	1,2	1,03	3
<i>Mimusops caffra</i>	1,0	0,8	1,2	1,0	0,46	6
<i>Plectroniella armata</i>	1,3	1,0	0,4	0,9	0,16	7
<i>Mimusops obovata</i>	0,5	0,4	1,5	0,8	0,58	3
<i>Cussonia sphaerocephala</i>	0,5	0,4	1,0	0,6	0,39	3
<i>Inhambanella henriquesii</i>	0,9	0,8	0,2	0,6	0,08	6
<i>Acacia karroo</i>	0,7	0,6	0,3	0,5	0,12	4
<i>Bersama lucens</i>	0,5	0,4	0,2	0,4	0,08	3
<i>Cassipourea gerrardii</i>	0,5	0,4	0,2	0,4	0,08	3
<i>Maytenus nemorosa</i>	0,5	0,4	0,2	0,4	0,08	3
<i>Clausena anisata</i>	0,5	0,4	0,1	0,3	0,04	3
<i>Ficus natalensis</i>	0,2	0,2	0,6	0,3	0,24	1
<i>Canthium ventosum</i>	0,2	0,2	0,2	0,2	0,08	1
<i>Celtis durandii</i>	0,2	0,2	0,2	0,2	0,08	1
<i>Cordia caffra</i>	0,3	0,2	0,1	0,2	0,04	1
<i>Turraea floribunda</i>	0,3	0,2	0,2	0,2	0,08	1
<i>T. obtusifolia</i>	0,2	0,2	0,1	0,2	0,04	1
Total	99,7	99,7	100,1	99,8	39,46	696

Tree height: mean for the community	9,7 m
maximum for the community	19,5 m

value of 20,3 per cent in the canopy stratum (Table 1). Although this species does not attain the size of the emergent species such as *Ziziphus mucronata* it has such a high density that its total basal cover of 5,96 m²/ha exceeds that of every other species present (Table 1).

Celtis africana is the subdominant of the community and has an importance value of 10,3 per cent. This species is also widespread through the forest, but is less common on the steep slope.

Other important component species of the canopy stratum are *Strychnos madagascariensis*, *Linociera peglerae*, *Teclea gerrardii*, *Ziziphus mucronata*, *Sideroxylon inerme* and *Diospyros inhacaensis*. These species have importance values that range from 8,8 to 5,6 per cent (Table 1).

Although not apparent from Table 1, the three separate surveys of the foot, slope and crest of the dune indicated that *Diospyros inhacaensis* is more common at the foot, *Sideroxylon inerme* attains its highest value on the slope and *Ziziphus mucronata* is most common at the foot and crest but is nearly absent from the slope. These distribution patterns may be caused by a less favourable moisture régime on the steep slope where loss due to runoff is likely to be higher than at the foot and crest. Venter (1973) found a comparable distribution pattern in the dune forest at Lake Sibayi where *Ziziphus mucronata* and *Diospyros inhacaensis* are dominant along the dune foot, but absent from the slope, while *Sideroxylon inerme* is an important member of the slope forest, but not so at the foot.

The density of the canopy stratum amounts to 696 trees/ha which is considerably more than the mean totals of 496 and 504 trees/ha determined respectively for the Hawaan and Hlogwene dune forests by Roger and Moll (1975). (These authors' criteria for canopy and subcanopy together equal the criterium for the canopy in the present study.) Venter (1973) found the mean densities for the canopy strata of the dune forests at Lake Sibayi and Richards Bay to be 478 and 385 respectively. The high density may be attributed to climatic factors which are obviously more favourable at Mapelana than at any other locality along the coast of Natal. The mean annual precipitation at Cape St Lucia for example, amounts to 1 287,9 mm/annum, compared to 1 105,8; 934,8; 947,8 and 923 mm/annum respectively at Richards Bay, Maputa (Kosi Bay), Mbazwane (Lake Sibayi) and Mt Edgecombe in the vicinity of the Hawaan forest (Venter, 1973, Breene, 1971, and Moll, 1968).

The basal cover of the canopy stratum totals 39,46 m²/ha. Again this value is high if compared to the values of 31,94 and 23,56 m²/ha measured at Richards Bay and Lake Sibayi respectively (Venter, 1973). This is also higher than the values of 34,88 and 24,90 m²/ha measured at Hawaan and Hlogwene forests respectively by Roger and Moll (1975).

The mean height of the forest canopy is 9,7 m (Table 1), but large emergents occur frequently, especially at the dune foot. The maximum height that was measured, was 19,5 m for an individual of *Mimusops caffra*.

TABLE 2.

Relative frequency and density, importance values and density per hectare of the subcanopy species in the *Diospyros natalensis* community.

(Summary of the data of a survey of 160 points)

	RF	RD	IV	D/ha
<i>Diospyros natalensis</i> *	13,4	15,2	14,3	189
<i>Psychotria capensis</i>	12,2	15,9	14,1	198
<i>Drypetes natalensis</i> *	8,3	8,3	8,3	103
<i>Deinbollia oblongifolia</i>	5,4	5,9	5,7	73
<i>Linociera peglerae</i> *	5,6	5,7	5,7	71
<i>Pancovia golungensis</i>	5,1	5,2	5,2	65
<i>Dovyalis longispina</i> *	5,1	4,3	4,7	53
<i>Eugenia natalitia</i> *	4,6	4,4	4,5	55
<i>Dracaena hookeriana</i>	4,5	4,3	4,4	53
<i>Vangueria chartacea</i>	4,2	3,8	4,0	47
<i>Clausena anisata</i>	2,4	2,0	2,2	25
<i>Teclea gerrardii</i> *	2,3	2,0	2,2	25
<i>Celtis africana</i> *	2,3	1,9	2,1	24
<i>Strychnos madagascariensis</i> *	1,8	1,9	1,9	24
<i>Diospyros inhacaensis</i> *	2,0	1,6	1,8	20
<i>Carissa bispinosa</i>	1,8	1,6	1,7	20
<i>Cassine papillosa</i> *	1,5	1,5	1,5	19
<i>Plectroniella armata</i> *	1,3	1,2	1,3	15
<i>Pavetta revoluta</i>	1,3	1,0	1,2	12
<i>Sideroxylon inerme</i> *	1,3	1,1	1,2	14
<i>Inhambanella henriquesii</i> *	1,1	0,9	1,0	12
<i>Maytenus nemorosa</i>	1,0	0,8	0,9	10
<i>Peddiea africana</i>	1,0	0,8	0,9	10
<i>Acalypha glabrata</i>	0,7	0,6	0,7	7
<i>Tricalysia sonderiana</i>	0,7	0,6	0,7	7
<i>Turraea obtusifolia</i>	0,8	0,6	0,7	7
<i>Xeromphis rudis</i>	0,7	0,6	0,7	7
<i>Cassine aethiopica</i> *	0,5	0,6	0,6	7
<i>Bequaertiodendron natalense</i>	0,5	0,4	0,5	5
<i>Euclea schimperi</i> *	0,5	0,4	0,5	5
<i>Mimusops caffra</i> *	0,5	0,4	0,5	5
<i>Turraea floribunda</i>	0,5	0,4	0,5	5
<i>Bersama lucens</i> *	0,2	0,2	0,2	3
<i>Brachylaena discolor</i>	0,2	0,2	0,2	3
<i>Canthium ventosum</i>	0,2	0,2	0,2	3
<i>Clerodendrum glabrum</i> *	0,2	0,2	0,2	3
<i>Euclea natalensis</i> *	0,2	0,2	0,2	3
<i>Ficus polita</i> *	0,2	0,2	0,2	3
<i>Gardenia thunbergia</i>	0,2	0,2	0,2	3
<i>Grewia occidentalis</i>	0,2	0,2	0,2	3
<i>Heywoodia lucens</i> *	0,2	0,2	0,2	3
<i>Kraussia floribunda</i>	0,2	0,2	0,2	3
<i>Mimusops obovata</i> *	0,2	0,2	0,2	3
<i>Mitrostigma axillare</i>	0,2	0,2	0,2	3
<i>Pavetta delagoensis</i>	0,2	0,2	0,2	3
<i>Strychnos decussata</i> *	0,2	0,2	0,2	3
<i>Trichilia emetica</i> *	0,2	0,2	0,2	3
<i>Ziziphus mucronata</i> *	0,2	0,2	0,2	3
Total	98,1	99,1	99,4	1 240

*Canopy species.

As in the case of the canopy stratum, *Diospyros natalensis* is once more dominant in the subcanopy with an importance value of 14,3 per cent (Table 2). *Psychotria capensis* has an equally high value of 14,1 per cent. *Diospyros natalensis*, however, is important throughout the community, while *Psychotria capensis* attains importance only at the summit and foot of the dune and is not encountered on the slope.

Pyrecantha scandens, *Rhoicissus* sp. and *Scutia myrtina* are the most common liana species present. They have importance values of respectively 16,1; 12,7 and 11,1 per cent (Table 3). On the basis of basal cover, however, *Scutia myrtina* and

TABLE 3.

Relative frequency, density and dominance, importance values and density per hectare of the liana species in the *Diospyros natalensis* community.
(Summary of the data of a survey of 160 points)

	RF	RD	RDo	IV	D/ha
<i>Pyrenacantha scandens</i>	20,0	24,0	4,2	16,1	488
<i>Rhoicissus</i> sp.	12,3	17,1	8,8	12,7	348
<i>Scutia myrtina</i>	6,1	4,7	22,4	11,1	96
<i>Grewia caffra</i>	4,5	4,1	20,5	9,7	83
<i>Acacia kraussiana</i>	9,8	8,9	5,5	8,1	181
<i>Cissus fragilis</i>	7,8	7,7	1,6	5,7	157
<i>Pergularia daemia</i>	6,1	5,5	2,9	4,8	112
<i>Grewia occidentalis</i>	2,4	2,0	8,4	4,3	41
<i>Uvaria caffra</i>	4,2	4,0	4,3	4,2	81
<i>Rhoicissus tomentosa</i>	1,2	1,8	5,4	2,8	37
<i>Asparagus falcatus</i>	4,0	3,0	1,2	2,7	61
<i>A. setaceus</i>	3,6	3,2	0,7	2,5	65
<i>Capparis fascicularis</i>	2,7	2,0	2,6	2,4	41
<i>Adenia gummifera</i>	1,2	0,9	3,5	1,9	19
<i>Pisonia aculeata</i>	1,2	0,8	3,1	1,7	16
<i>Rhus natalensis</i>	1,6	1,7	1,8	1,7	35
<i>Tinospora caffra</i>	1,6	1,1	0,5	1,1	22
<i>Cyphostemma cirrhosum</i>	1,5	1,1	0,2	0,9	22
<i>Hippocratea schlechteri</i>	0,9	0,8	0,3	0,7	16
<i>Ceropegia grandis</i>	0,8	0,8	0,3	0,6	16
<i>Brachylaena discolor</i>	0,6	0,4	0,4	0,5	8
<i>Secamone frutescens</i>	0,8	0,7	0,1	0,5	14
<i>Allocassine laurifolia</i>	0,6	0,4	0,1	0,4	8
<i>Cynanchum ellipticum</i>	0,6	0,4	0,1	0,4	8
<i>Jasminum streptopus</i>	0,6	0,4	0,1	0,4	8
<i>Senecio mikanioides</i>	0,6	0,4	0,1	0,4	8
<i>Vernonia angulifolia</i>	0,6	0,4	0,1	0,4	8
<i>Tragia rupestris</i>	0,6	0,4	0,1	0,4	8
<i>Monanthotaxis caffra</i>	0,5	0,4	0,1	0,3	8
<i>Maerua racemulosa</i>	0,3	0,2	0,4	0,3	4
<i>Cissampelos torulosa</i>	0,3	0,2	0,0	0,2	4
<i>Dioscorea sylvatica</i>	0,3	0,2	0,0	0,2	4
<i>Tylophora anomala</i>	0,3	0,2	0,0	0,2	4
Total	100,2	99,9	99,8	100,3	2 031

Grewia caffra outranks all the other liana species by far with relative dominance values of 22,4 and 20,5 per cent respectively.

These last-mentioned two species very obviously constitute an important component of the forest-canopy stratum. The canopies of these two climbers become so massive that one often observes broken trees where the mass of these two species had become so excessive that the supporting tree branches had torn off and the whole canopy, tree and liana, dropped to the forest floor. Strong winds, of course, may play a part in this destruction. In these places, where the forest-canopy has opened up, more sunlight penetrates to the herb stratum and this results in a spectacular upsurge of seedlings and saplings.

Not many of the lianas present attain impressive stem dimensions, even though they reach up into the forest canopy. The maximum stem diameters measured

TABLE 4.

True and relative frequency of the herb stratum species of the *Diospyros natalensis* community.
(Summary of the data of 160 quadrats of 1 m² each)

	TF**	RF
<i>Isoglossa woodii</i>	58,3	11,1
<i>Diospyros natalensis</i> *	55,8	10,6
<i>Psychotria capensis</i>	30,8	5,8
<i>Eugenia natalitia</i> *	25,0	4,8
<i>Teclea gerrardii</i> *	24,2	4,6
<i>Linociera peglerae</i> *	22,6	4,3
<i>Drypetes natalensis</i> *	20,0	3,8
<i>Clausena anisata</i>	19,2	3,6
<i>Dracaena hookeriana</i>	18,3	3,5
<i>Acacia kraussiana</i>	14,2	2,7
<i>Asparagus falcatus</i>	13,3	2,5
<i>Pyrenacantha scandens</i>	13,3	2,5
<i>Phymatodes scolopendria</i>	12,5	2,4
<i>Oplismenus hirtellus</i>	11,7	2,2
<i>Uvaria caffra</i>	11,7	2,2
<i>Cyperus albostratus</i>	10,8	2,1
<i>Hippocratea schlechteri</i> var. <i>peglerae</i>	10,8	2,1
<i>Asparagus setaceus</i>	9,2	1,7
<i>Capparis fascicularis</i> var. <i>zeyheri</i>	8,3	1,6
<i>Deinbollia oblongifolia</i>	8,3	1,6
<i>Drimiopsis maculata</i>	6,7	1,3
<i>Cissus fragilis</i>	6,7	1,3
<i>Pupalia atropurpurea</i>	6,7	1,3
<i>Sansevieria guineensis</i>	6,7	1,3
<i>Strychnos madagascariensis</i>	6,7	1,3
<i>Cyphostemma cirrhosum</i>	5,8	1,1
<i>Pavetta revoluta</i>	5,8	1,1
<i>Pancovia golungensis</i>	5,8	1,1
<i>Carissa bispinosa</i> var. <i>acuminata</i>	4,2	0,8
<i>Peddiea africana</i>	4,2	0,8
<i>Allophylus melanocarpus</i>	3,3	0,6
<i>Gardenia thunbergia</i>	3,3	0,6

	TF**	RF
<i>Cassine aethiopica</i> *	2,5	0,5
<i>Celtis africana</i> *	2,5	0,5
<i>Coleotrype natalensis</i>	2,5	0,5
<i>Commicarpus africanus</i>	2,5	0,5
<i>Mimusops obovata</i> *	2,5	0,5
<i>Plectroniella armata</i> *	2,5	0,5
<i>Secamone frutescens</i>	2,5	0,5
<i>Tragia rupestris</i>	2,5	0,5
<i>Vangueria chartacea</i>	2,5	0,5
<i>Vernonia angulifolia</i>	2,5	0,5
<i>Acalypha glabrata</i>	1,7	0,3
<i>Anthericum saundersiae</i>	1,7	0,3
<i>Bequaertiiodendron natalense</i>	1,7	0,3
<i>Ceropegia grandis</i>	1,7	0,3
<i>Chaetacme aristata</i> *	1,7	0,3
<i>Ctenomeria capensis</i>	1,7	0,3
<i>Dioscorea cotinifolia</i>	1,7	0,3
<i>Diospyros inhacaensis</i> *	1,7	0,3
<i>Tricalysia lanceolata</i>	1,7	0,3
<i>Xeromphis rudis</i>	1,7	0,3
<i>Ziziphus mucronata</i> *	1,7	0,3
<i>Achyranthes sicula</i>	0,8	0,2
<i>Allocassine laurifolia</i>	0,8	0,2
<i>Asplenium prionitis</i>	0,8	0,2
<i>Bersama lucens</i> *	0,8	0,2
<i>Cassine papillosa</i> *	0,8	0,2
<i>Commelina benghalensis</i>	0,8	0,2
<i>Cynanchum ellipticum</i>	0,8	0,2
<i>Euclea schimperi</i> var. <i>schimperi</i> *	0,8	0,2
<i>Grewia occidentalis</i>	0,8	0,2
<i>Haemanthus</i> sp. (HJTV 6139)	0,8	0,2
<i>Laportea peduncularis</i>	0,8	0,2
<i>Maytenus mossambicensis</i> var. <i>mossambicensis</i>	0,8	0,2
<i>Ochna natalitia</i> *	0,8	0,2
<i>Pavetta delagoensis</i>	0,8	0,2
<i>Pergularia daemia</i>	0,8	0,2
<i>Rhoicissus</i> sp. (HJTV 5549)	0,8	0,2
<i>Rhynchosia</i> cf. <i>R. caribaea</i>	0,8	0,2
<i>Senecio mikanioides</i>	0,8	0,2
<i>Tricalysia sonderiana</i>	0,8	0,2
<i>Turraea obtusifolia</i>	0,8	0,2
<i>Vernonia anisochaetoides</i>	0,8	0,2
Species (HJTV 5510)	0,8	0,2
Total		101,0

Shading: minimum — 5 per cent.
maximum — 95 per cent.
mean — 66 per cent.

*Canopy species.

**TF = True frequency.

were 12 and 11 cm (at breast-height) for *Scutia myrtina* and *Grewia caffra* respectively. The majority of the climbers have stem diameters of less than 1 cm.

A large variety of species grow in the herb stratum (Table 4). *Isoglossa woodii*, a woody acanthaceous herb, is most conspicuous and without a doubt exerts a dominating influence on the forest vegetation. Wherever present, this species grows into an extremely dense cover of up to 3 m high. Its canopy becomes so dense that hardly any sunlight filters through to the forest floor where other smaller plants and tree seedlings are present. It was observed that *Isoglossa woodii* is especially abundant in shade, but it may be as abundant in exposed patches.

TABLE 5.

Epiphytes and their supporting plants in the *Diospyros natalensis* community.
(Summary of the data obtained during the survey of 160 points)

	supporting plants								
	<i>Acacia kraussiana</i>	<i>Chaetacme aristata</i>	<i>Diospyros inhacaensis</i>	<i>Diospyros natalensis</i>	<i>Eugenia natalitia</i>	<i>Linociera peglerae</i>	<i>Sideroxylon inerme</i>	<i>Strychnos madagascariensis</i>	<i>Ziziphus mucronata</i>
epiphytes	number of times observed								
<i>Ansellia gigantea</i>	.	.	1	.	.	.	.	.	.
<i>Dermatobotrys saundersii</i>	.	.	.	.	.	.	1	.	.
<i>Cyrtorchis arcuata</i>	.	.	.	.	1	.	1	.	.
<i>Microcoelia exilis</i>	.	.	1	.	.	.	.	1	.
<i>Mystacidium flanaganii</i>	1	.	.	2	1	.	.	.	.
<i>Ficus craterostoma</i> *	.	.	1	.	.	.	.	.	.
<i>F. natalensis</i> *	.	.	1	.	.	.	.	.	.
<i>F. polita</i> *	.	.	.	.	.	.	.	.	1
<i>Microsorium punctatum</i> **	.	5	3	1	.	1	.	1	5
<i>Phymatodes scolopendria</i> **†	.	1	3	.	.	.	.	.	2

*Hemi-epiphyte.

**Also present on the forest floor.

†Starts off as a climber, but becomes an epiphyte as the older stems die off.

After *Isoglossa woodii*, seedlings of *Diospyros natalensis* have the highest relative frequency of 10.6 per cent (Table 4). These seedlings may be encountered regularly throughout the community. Other species of the herb stratum with high frequency are *Psychotria capensis*, *Eugenia natalitia*, *Teclea gerrardii* and *Linociera peglerae*.

It furthermore becomes apparent from Table 4 that as many as 15 canopy species are represented in the herb stratum, a fact which may bear an influence on the future composition of the forest canopy.

Epiphytes are not rare in the Mapelana Forest, although only five true epiphytic species, of which four are orchids, were observed during the survey (Table 5). The ferns *Microsorium punctatum* and *Phymatodes scolopendria*, are found most commonly, while the three hemi-epiphytic *Ficus* species may be encountered sporadically.

The *Diospyros natalensis* community is apparently free of macrophytic plant parasites as none were observed during the survey, except one specimen of *Loranthus kraussianus* which grew on an individual of *Acacia karroo* just outside the forest.

A remarkable characteristic of the Mapelana Forest is its floristic richness. No less than 146 species were encountered during the survey as shown in the check-list. This finding supports the statements of Richards (1957), Longman and Jeník (1974) and Roger and Moll (1975) that the tropical and subtropical forests are remarkably rich compared to the temperate forests.

Quite a few species present in the Mapelana Forest are of tropical affinity and hardly occur farther south than the St Lucia area. These include *Diospyros inhacaensis*, *Inhambanella henriquesii*, *Celtis durandii* and *Pancovia golungensis*.

CONCLUSION

The Mapelana Forest exhibits a very luxuriant plant growth with an accompanying high density of the various strata present. This may be ascribed to particularly favourable climatic conditions for plant growth which prevail in the area.

The forest furthermore exhibits two clearly distinguishable communities due to the influence of salt-spray from the sea. The most extensive of these is the *Diospyros natalensis* community which covers the hinddune and which is not affected by the salt-spray. The other occurs on the foredune where salt-spray poisoning is intense. *Mimusops caffra* and *Strelitzia nicolai* are the most conspicuous trees on the foredune.

From the remarkable importance of *Diospyros natalensis* in all strata throughout the hinddune it could be deduced with reasonable certainty that the *Diospyros natalensis* community has reached a stable climax in which there will be no change in the dominance of this species under the prevailing environmental conditions. To the author's knowledge, the Mapelana Forest is the only locality in its range of distribution in South Africa where *Diospyros natalensis* has become the dominant of a forest community.

Both *Celtis africana* and *Ziziphus mucronata* are notably poorly represented in the lower strata. These two species may thus eventually show a decline in importance as the full-grown individuals die out and are not replaced by young plants. In contrast *Linociera peglerae*, *Drypetes natalensis* and *Eugenia natalitia* at present comprise important components of the lower strata and may be future subdominants of the community.

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CHECK-LIST OF PLANT SPECIES COLLECTED OR SAMPLED DURING THE SURVEY OF THE MAPELANA FOREST

A total of 146 species, representing 117 genera and 54 families, is listed, but the check-list is not complete since the collecting was not made on an intensive scale. The families and genera are classified in systematic order according to Schelpe

(1969) and Ross (1972). Where more than one species occur in a genus, these are arranged alphabetically.

The Rubiaceae is the largest family and is represented by 10 genera and 11 species. The largest genera listed are *Ficus* and *Diospyros* with 6 and 4 species respectively.

Forty-eight of the species listed are canopy trees, 36 are subcanopy trees or shrubs, 35 are lianas and 27 species belong to the herb stratum.

PTERIDOPHYTA

POLYPODIACEAE

Phymatodes scolopendria (Burm.)

Ching

Microsorium punctatum (L.) Copel.

ASPLENIACEAE

Asplenium prionites Kunze

ANGIOSPERMAE

POACEAE

Oplismenus hirtellus (L.) Beauv.

CYPERACEAE

Cyperus albostratus Schrad.

C. papyrus L.

COMMELINACEAE

Commelina benghalensis L.

Coloetypus natalensis C.B.Cl.

LILIACEAE

Anthericum saundersiae Bak.

Drimiopsis maculata Lindl.

Dracaena hookeriana K. Koch

Sansevieria guineensis (L.) Willd.

Asparagus falcatus L.

A. setaceus (Kunth) Jessop

AMARYLLIDACEAE

Haemanthus sp. (HJTV 5506)

DIOSCOREACEAE

Dioscorea cotinifolia Kunth

D. sylvatica (Kunth) Eckl.

MUSACEAE

Strelitzia nicolai Reg. & Koern.

ORCHIDACEAE

Ansellia gigantea Reichb.f.

Cyrtorchis arcuata (Lindl.) Schltr.

Mystacidium flanaganii (Bol.) Bol.

Microcoelia exilis Lindl.

ULMACEAE

Celtis africana Burm.f.

C. durandii Engl.

Chaetacme aristata Planch.

MORACEAE

Ficus burtt-davyi Hutch.

F. craterostoma Warb. ex Mildbr. &

Burret

F. hippopotami Gerstner

F. natalensis Hochst.

F. polita Vahl

F. sycomor L.

URTICACEAE

Laportea peduncularis (Wedd.) Chew.

LORANTHACEAE

Loranthus kraussianus Meisn.

AMARANTHACEAE

Pupalia atropurpurea Moq.

Achyranthes sicala (L.) All.

NYCTAGINACEAE

Commicarpus africanus (Lour.) Dandy

Pisonia aculeata L.

MENISPERMACEAE

Cissampelos torulosa E.Mey. ex Herv.

Tinospora caffra (Miers) Troupin

ANNONACEAE

Uvaria caffra E.Mey. ex Sond.

Monanthes caffra (Sond.) Verdc.

Annona senegalensis Pers.

Monodora junodii Engl. & Diels

CAPPARACEAE

Cladostemon kirkii (Oliv.) Pax & Gilg

Capparis fascicularis DC. var. *zeyheri*

(Turcz.) Toelken

Maerua racemulosa (A.DC.) Gilg &

Ben.

LEGUMINOSAE

Acacia karroo Hayne
A. kraussiana Meisn. ex Benth.
Rhynchosia caribaea (Jacq.) DC.

RUTACEAE

Teclea gerrardii Verdoorn
T. natalensis (Sond.) Engl.
Clausena anisata (Willd.) Hook.f. ex Benth.

MELIACEAE

Turraea floribunda Hochst.
T. obtusifolia Hochst.
Trichilia emetica Vahl

EUPHORBIACEAE

Heywoodia lucens Sim.
Drypetes natalensis (Harv.) Hutch.
Bridelia cathartica Bertol.f.
B. micrantha (Hochst.) Baill.
Acalypha glabrata Thunb.
Tragia rupestris Sond.
Ctenomeria capensis (Thunb.) Harv. ex Prain

ANACARDIACEAE

Rhus natalensis Bernh.
R. nebulosa Schönl.

CELASTRACEAE

Maytenus mossambicensis (Klotzsch) Blakelock var. *mossambicensis*
M. nemorosa (Eckl. & Zeyh.) Marais
M. procumbens (L.f.) Loes.
Cassine aethiopica Thunb.
C. papillosa (Hochst.) Kuntze
Allocassine laurifolia (Harv.) N. Robson

HIPPOCRATEACEAE

Hippocratea schlechteri Loes. var. *peglerae* Loes.

ICACINACEAE

Apodytes dimidiata E.Mey. ex Arn.
Pyrenacantha scandens Planch. ex Harv.

SAPINDACEAE

Allophylus dregeanus (Sond.) de Wint.
A. melanocarpus (Sond.) Radlk.
A. natalensis (Sond.) de Wint.
Deinbollia oblongifolia (Sond.) Radlk.
Pancovia golungensis (Hiern) Exell & Mendonca

MELIANTHACEAE

Bersama lucens (Hochst.) Szyszyl.

RHAMNACEAE

Ziziphus mucronata Willd.
Scutia myrtina (Burm.f.) Kurz

VITACEAE

Rhoicissus tomentosa (Lam.) Wild & Drumm.
R. species (HJTV 5549)
Cissus fragilis E.Mey.
Cyphostemma cirrhosum (Thunb.) Desc. ex Wild & Drumm.

TILIACEAE

Grewia caffra Meisn.
G. occidentalis L.

MALVACEAE

Hibiscus tiliaceus L.

OCHNACEAE

Ochna natalitia (Meisn.) Walp.

FLACOURTIACEAE

Dovyalis longispina (Harv.) Warb.

PASSIFLORACEAE

Adenia gummifera (Harv.) Harms

THYMELAEACEAE

Peddiea africana Harv.

LECYTHIDACEAE

Barringtonia racemosa (L.) Spreng.

RHIZOPHORACEAE

Cassipourea gerrardii (Schinz) Alston

MYRTACEAE

Eugenia gueinzii Sond.
E. natalitia Sond.
E. zeyheri Harv.
Syzygium cordatum Hochst.

ARALIACEAE

Cussonia sphaerocephala Strey

SAPOTACEAE

Sideroxylon inerme L.
Bequaertiodendron natalense (Sond.) Heine & J.H.Hemsl.
Mimusops caffra E.Mey. ex A.DC.
M. obovata Sond.
Manilkara discolor (Sond.) J.H.Hemsl.

Inhambanella henriquesii (Engl. & Warb.) Dubard

EBENACEAE

Euclea natalensis A.DC.

E. schimperi (A.DC.) Dandy var. *schimperi*

Diospyros inhacaensis F.White

D. natalensis (Harv.) Brenan

D. rotundifolia Hiern

D. scabrida (Harv. ex Hiern) de Wint. var. *scabrida*

OLEACEAE

Linociera peglerae (C.H.Wr.) Gilg & Schellenb.

Olea capensis L. subsp. *macrocarpa* (C.H.Wr.) Verdoorn

Jasminum streptopus E.Mey. var. *streptopus*

LOGANIACEAE

Strychnos decussata (Pappe) Gilg

S. madagascariensis Poir.

APOCYNACEAE

Carissa bispinosa (L.) Desf. ex Brenan var. *acuminata* (E.Mey.) L.E.Codd

Voacanga thouarsii Roem. & Schult.

Rauvolfia caffra Sond.

ASCLEPIADACEAE

Cynanchum ellipticum (Harv.) R.A.Dyer

Secamone frutescens Decne

Ceropegia grandis Bruce

Tylophora anomala N.E.Br.

Pergularia daemia (Forsk.) Chiov.

BORAGINACEAE

Cordia caffra Sond.

VERBENACEAE

Clerodendrum glabrum E.Mey.

LAMIACEAE

Leonotis laxifolia MacOwan

SCROPHULARIACEAE

Dermatobotrys saundersii Bol.

ACANTHACEAE

Asystasia gangetica (L.) T.Anders.

Isoglossa woodii C.B.Cl.

RUBIACEAE

Mitriostigma axillare Hochst.

Xeromphis rudis (E.Mey. ex Harv.) L.E.Codd

Gardenia thunbergia L.f.

Tricalysia lanceolata (Sond.) Burt Davy

T. sonderiana Hiern

Kraussia floribunda Harv.

Vangueria chartacea Robyns

Canthium ventosum (L.) S.Moore

Plectroniella armata (K.Schum.) Robyns

Pavetta revoluta Hochst.

Psychotria capensis (Eckl.) Vatke

COMPOSITAE

Vernonia angulifolia DC.

V. anisochaetoides Sond.

Brachylaena discolor DC.

Senecio mikanioides Otto

S. tamoides DC.